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(54) Title: REPORTING THE STATE OF AN APPARATUS TO A REMOTE COMPUTER

(57) Abstract: The state of an apparatus is reported to a remote computer using an embedded device in the apparatus. The embedded device detects the state, generates a message that reports the state using a self-describing computer language, and sends the message to the remote computer. The remote computer receives the message and extracts the state of the embedded device from the message.

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REPORTING THE STATE OF AN APPARATUS TO A REMOTE COMPUTER

Background

This invention relates to using a device embedded in an apparatus (an "embedded device") to report the state of the apparatus to a remote computer.

An apparatus may contain an embedded device, such as a controller, to monitor and control its operation. Any type of apparatus may have an embedded device, including, but not limited to, home appliances, such as washing machines, dishwashers, and televisions, and manufacturing equipment, such as robotics, conveyors and motors.

Embedded devices are often connected to an internal network, such as a local area network (LAN), with an interface to the Internet. Other devices on the internal network may communicate with the embedded devices over the internal network.

Summary

In general, in one aspect, the invention is directed to using a device embedded in an apparatus to report the state of the apparatus to a remote computer. This aspect of the invention features detecting the state of the apparatus, generating a message that reports the state of the apparatus using a self-describing computer language, and sending the message to the remote computer. An

example of a self-describing computer language is eXtensible Markup Language (XML). Examples of messages that may be sent include an electronic mail (e-mail) message and a hypertext transfer protocol (HTTP) command, both containing XML code.

By virtue of the device-generated message, the remote computer can obtain the state of the apparatus even if the remote computer cannot directly address the embedded device. Thus, computers that cannot communicate directly with the embedded device, such as computers that are not on the same internal network as the embedded device, can still obtain the status of the apparatus. Moreover, because the state is reported using a self-describing computer language, the remote computer can interpret the state without the aid of a person. As a result, processes, such as maintenance and the like, can be scheduled automatically for the apparatus and/or embedded device by the remote computer.

This aspect of the invention may include one or more of the following features. The state is indicative of an error condition in the apparatus. The error condition is a variable that deviates from an acceptable value or a predetermined range of acceptable values. The function of detecting the state includes receiving the state from the apparatus by, e.g., retrieving the state periodically from the apparatus. The function of detecting the state

includes obtaining an identifier for the apparatus, the identifier relating to the state of the apparatus, and using the embedded device to read the state from the apparatus using the identifier.

This aspect of the invention may also include determining if the state of the apparatus has changed. The message is generated if the state of the apparatus has changed and is not generated otherwise. The function of determining if the state of the apparatus has changed includes comparing the state received from the apparatus to a previous state of the apparatus.

The message is generated using a predefined template by obtaining one or more variables relating to the apparatus and inserting the one or more variables into the template. The state of the apparatus may be included as part of a body of an e-mail message or as part of an attachment to the e-mail message. The state of the apparatus may be included as part of an HTTP command.

In general, in another aspect, the invention is directed to obtaining a state of an apparatus from a device, such as a controller, embedded in the apparatus. This aspect of the invention features receiving a message that reports the state of the apparatus using a self-describing computer language and extracting the state of the apparatus from the message.

This aspect of the invention may include one or more of the following features. The self-describing computer language is XML. The state of the apparatus is indicative of an error condition in the apparatus. The error condition is a variable that deviates from an acceptable value or a predetermined range of acceptable values. The state of the apparatus is passed to a customer relationship management system. The message may be included in an HTTP command or may be part of an e-mail.

In general, in another aspect, the invention features a system that includes first and second devices. The first device includes circuitry that generates a message reporting a state of an apparatus using a self-describing computer language. The second device is in communication with the first device. The second device includes circuitry that receives the electronic mail message from the first device.

This aspect of the invention may include one or more of the following features. The second device receives the message from the first device and extracts the state of the apparatus from the message. The first device is embedded in the apparatus and the second device is a remote computer. The message may be included in an HTTP command or may be part of an e-mail.

Other features and advantages of the invention will become apparent from the following description, including the claims and drawings.

Brief Description of the Drawings

Fig. 1 is a block diagram of a network containing a remote computer and an apparatus having an embedded device;

Fig 2 shows the format of a tag used to store state variables for the apparatus;

Fig. 3 is flowchart of a process performed by the embedded device to report the state of the apparatus to the remote computer;

Fig. 4 is a flowchart of an alternative process performed by the embedded device to report the state of the apparatus to the remote computer;

Fig. 5 is a flowchart of a process performed by the remote computer to interpret messages received from the embedded device; and

Fig. 6 is a block diagram of a network containing a remote computer and an apparatus having an embedded device that reports on the state of the apparatus using HTTP commands.

Description

Fig. 1 shows a network 10. Network 10 includes an apparatus 11 containing an embedded device 17, such as a controller (e.g., a microprocessor). Apparatus 11 is connected to an internal network 12, such as a LAN. A router or modem 14 interfaces internal network 12 to an external network 15, such as the Internet, that runs TCP/IP (Transmission Control Protocol/Internet Protocol) or some other suitable protocol. Connections may be, e.g., via Ethernet, wireless link, or telephone line. External network 15 contains remote computer 16, which may be a server, a personal computer (PC), or any other type of processing device. Other devices (not shown) may be included on internal network 12 and external network 15.

Processing In The Embedded Device

Apparatus 11 may be any type of device or may be included in any system having functions that are monitored and controlled by embedded device 17. Among other things, embedded device 17 executes software stored in memory 19 to generate and send, to remote computer 16, an e-mail message reporting the state of apparatus 11.

Software 20 includes an OPC (OLE for Process Control) server program 21, an XML (eXtensible Markup

Language) processor program 24, and an e-mail program 25. E-mail program 25 is an SMTP-compliant (Simple Mail Transfer Protocol) program for sending e-mail from embedded device 17 to Internet addresses and for receiving e-mail from the Internet. E-mail program 25 operates as a mail transfer agent (MTA) for e-mail messages arriving at embedded device 17 and a mail delivery agent (MDA) for e-mail messages originating from embedded device 17. Other mail transfer protocols and programs may be also used by embedded device 17 in addition to, or instead of, those noted above.

XML processor program 24 is a program for generating XML code that reports the state of apparatus 11. XML is a self-describing computer language that defines variables and values relating to those variables. XML is self-describing in the sense that fields in the XML code identify variables and their values in the XML code. The template for XML used to generate an e-mail is as follows:

```
<name>temperature</name><value><##temperature##></value>,
```

where the "name" field identifies the name of a variable and the "value" field identifies the value of the variable that follows the "name" field. So, for the example given above, the variable is "temperature" and a

value (e.g., 33.8) may be inserted for that variable as follows:

<name>temperature</name><value>33.8</value>.

XML processor program 24 generates XML code having the above syntax from a tag database 22 stored in memory 19.

Tag database 22 contains tags for use by XML processor program 24 in generating XML code. Fig 2 shows an example of a format for a tag 26, although other formats may be used. Tag 26 contains a name field 27, a description field 29, a value field 30, a time stamp field 31, and an item identifier (ID) field 32. These fields are used to obtain, identify and store information relating to apparatus 11.

Name field 27 holds the name of a state variable for apparatus 11, such as "temperature", and description field 29 provides further identification information, such as "temperature of fluid in a tank". Value field 30 holds the value of the state variable and time stamp field 31 holds the time that the value in value field 30 was obtained. Value field 30 may include a variant, which is a construct that holds the value as an integer, a real number, a boolean, a character string, or some other type. Item ID field 32 holds an identifier that corresponds to hardware that is being monitored within

apparatus 11. The identifier corresponds to a register location or to some other storage area of apparatus 11 that contains the value for field 30. For example, if embedded device 17 is in a robotics system, item ID field 32 might correspond to a register in the robotics system that contains a velocity or position of a robotic arm.

OPC server program 21 reads item IDs from field 32 and uses those item IDs to read variable values from corresponding hardware storage areas 34. OPC server program 21 implements an industrial automation protocol, such as MODBUS TCP, to communicate with the apparatus hardware. The system is not limited to use with the MODBUS protocol or with OPC server program 21; any drivers or computer programs may be used to read the state variable values from the hardware. Once a state variable value has been read, OPC server program 21 inserts the variable value into field 30 of the appropriate tag.

Fig. 3 shows a process 36 for reporting the state of apparatus 11 to remote computer 16 using e-mail. In this embodiment, process 36 is implemented by OPC server program 21, XML processor program 24, e-mail program 25, and system software (not shown) executing in embedded device 17. The system software may include an operating system or other programs that control the background operation of embedded device 17.

Process 36 detects (301) the state of apparatus 11. The state may be indicative of an error condition (described below) within apparatus 11 or it may simply be state variables of apparatus 11 that are obtained at a particular time. To detect the state of apparatus 11, OPC server program 21 polls the hardware in apparatus 11 periodically. To perform this polling, OPC server program 21 obtains (301a) an item ID from tag database 22 and reads (301b) the value of a state variable that corresponds to the item ID from the appropriate hardware storage location. Process 36 may report the value to the remote computer as is or, alternatively, process 36 may use the value to identify and report an error condition in the hardware. A process for reporting error conditions is described below.

Process 36 generates (302) an e-mail message reporting the value of state variable(s) for apparatus 11. Specifically, XML processor program 24 retrieves both the name of each state variable and the value of the state variable from the appropriate tag(s) in tag database 22. Other variables may also be retrieved from tag database 22 including the time stamp, description, and whatever other variables are stored in tag database 22. Which information is retrieved is pre-set in XML processor program 24. The retrieved variables are used

by XML processor program 24 to generate XML code for an e-mail to remote computer 16.

XML processor program 24 may generate the XML code "on the fly", meaning without the use of a template. In this case, a blank XML file is populated with the retrieved variables in XML format by XML processor program 24. Alternatively, XML processor program 24 may generate the XML code using a pre-defined and formatted template. The template may be obtained by XML processor program 24, e.g., from memory 19 or a remote storage location (not shown). For example, the template may contain formatting similar to that shown above, namely:

<name>temperature</name><value><##temperature##></value>.

To generate the XML code from the template, XML processor program 24 scans through the template and inserts state variable value(s) retrieved from tag database 22, where appropriate. XML processor program 24 may generate the XML code periodically, depending upon how often e-mails are to be sent to the remote computer. Alternatively, tag manager software (not shown) may be included to provide newly-received tag variables to XML processor program 24. In this case, XML processor program 24 generates the XML code when it receives the new tag variables.

The resulting XML code may be part of the body of an e-mail or it may part of an attachment to an e-mail. The e-mail also contains a unique identifier, such as a code (e.g., serial number or identifier), that identifies embedded device 17 to remote computer 16. E-mail program 25 obtains the XML code from XML processor program 24 and sends it to remote computer 16 as part of the e-mail message. E-mail program 25 obtains the code periodically, depending upon the frequency at which e-mails are to be sent to the remote computer. The frequency is set beforehand in embedded device 17. The address of the remote computer may be registered with e-mail program 25 beforehand. Typically, the address/remote computer will be that of an entity that requires information about apparatus 11. For example, the entity may be a manufacturer of the apparatus, a plant monitoring system, or the like. The e-mail program sends the message to router/modem 14, which transfers it via external network 15 to remote computer 16. Then, the e-mail message is processed as described below.

The foregoing describes the case where embedded device 17 simply reports the state of apparatus 11 to remote computer 16 periodically. Alternatively, embedded device 17 may report the state to remote computer 16 only when an error condition or "alarm" is detected.

Fig. 4 shows a process 40 by which embedded device 17 detects error conditions in apparatus 11 and sends an e-mail message to remote computer 16 when an error condition is detected. Process 40 detects (401) the state of apparatus 11, where, as above, "state" refers to tag variable values for apparatus 11. Detection (401) is performed in the same manner as process 36; therefore, a description is omitted here. Once process 36 has obtained the state of apparatus 11, process 36 determines (402) if that state represents an error condition.

To detect an error condition, process 40 may compare an obtained state variable value to a predetermined acceptable value or a range of predetermined acceptable values. If the state variable value is outside the range of, or deviates considerably from, the acceptable value(s), then process 40 knows that an error condition is present. Alternatively, process 40 may store each state variable value in memory 19 as it is obtained, and compare each newly-received state variable value to one or more stored state variable values. If the new state variable value deviates by more than a predetermined amount from the stored value(s), process 40 knows that an error condition is present/has occurred.

An error condition may be based on a single state variable value or it may be based on some combination of two or more state variable values. For example, if

embedded device 17 is in manufacturing equipment that monitors both a level of fluid in a tank and a temperature of that fluid, an error condition may only be present if both the fluid level and the temperature exceed preset values. In this example, therefore, if only one state variable exceeds its corresponding preset value, then no error condition is present/has occurred.

If process 40 detects (402) an error condition, process 40 generates (403) an e-mail message and sends (404) the e-mail message to remote computer 16. The functions of generating and sending an e-mail message are performed as described above with respect to process 36; therefore, detailed descriptions are omitted here. When generating the e-mail message, e-mail program 25 may place the state variable(s) that caused the error condition in the "subject" line of the e-mail. If process 40 does not detect (402) an error condition, an e-mail message is not sent, whereafter process 40 returns to 401.

XML processor program 24 may maintain a log of error conditions in memory 19. This error condition "history" may be provided along with each new e-mail message. The history may relate to a particular state variable or to more than one state variable. For example, if the error condition pertains to temperature, XML processor program 24 may include the error condition history for

temperature in the e-mail. If the error condition pertains to both temperature and tank level, XML processor program 24 may include the error condition history for both temperature and tank level in the e-mail. If a template is used to generate the e-mail message, portion(s) of that template may be reserved for error condition history.

Processes 36 and 40 can be combined to generate an e-mail periodically that reports the state of apparatus 11 to remote computer 16 even if no error conditions have been detected in apparatus 11, and that also flags any error conditions if any have been detected. XML processor program 24 adds an indicator or the like next to state variable values that correspond to error conditions.

Processes 36 and 40 may be executed by embedded device 17 to monitor and report on any type of state variables in any type of apparatus. For example, processes 36 and 40 may detect state variable values relating to conveyor belt speed, current and/or voltage in electronic devices, tank fluid levels, input/output sensors, and the like. Processes 36 and 40 may detect state variable values through a programmable logic controller (PLC) that is connected to one or more other devices. A PLC includes plug-in cards for each device that obtain and store device state variable values. OPC

server program 21 communicates with these plug-in cards to obtain the device state variable values for generating e-mails as described above.

E-mails generated by processes 36 and 40 report the state of apparatus 11 using a self-describing computer language, such as XML; however, other types of self-describing computer languages may be used. In addition, other text and/or images may be included in the e-mails, if desired and appropriate under the circumstances. Described below is a process that is performed by remote computer 16 to interpret e-mails received from embedded device 17.

Processing In The Remote Computer

Remote computer 16 contains a controller 41 for executing software stored in memory 42. Among this software is e-mail program 44, XML parser 45, and customer relationship management (CRM) system software 46.

As in embedded device 17, e-mail program 44 is an SMTP-compliant program for receiving e-mail from embedded device 17 and other such devices. E-mail program 44 operates as a mail transfer agent (MTA) for e-mail messages arriving at remote computer 16 and a mail delivery agent (MDA) for e-mail messages originating from remote computer 16. E-mail program 44 uses the same

protocol as e-mail program 25 in embedded device 17.

XML parser 45 parses XML code in a received e-mail to extract variable values, including an identifier for apparatus 11. XML parser 45 recognizes field names, such as "name" and "value" from above and extracts corresponding state variable values from those fields. That is, XML parser 45 knows the syntax of XML. Knowing this, XML parser 45 is able to extract variable names from the "name" fields, corresponding variable values from the "value" fields, and any other information in the XML code.

XML parser 45 passes the state variable values, along with appropriate identifiers, to customer relationship management system software 46 or whatever other software or database requires/uses those state variable values.

Fig. 5 shows how an e-mail from embedded device 17 is processed (43). Once an e-mail has been received (501) from embedded device 17, XML parser 45 extracts (502) the state variable values of apparatus 11 from the e-mail. For example, XML parser 45 may extract tank levels, temperature values, etc., of apparatus 11 monitored by embedded device 17. The state variable values may be indicative of error conditions in apparatus 11, as defined above, or simply state variables for apparatus 11 obtained at a given point in time.

XML parser 45 passes (503) the state variable values, i.e., the state of apparatus 11, to customer relationship management system software 46. Customer relationship management system software 46 uses these state variable values, e.g., to schedule maintenance for apparatus 11 if necessary, to provide software upgrades to apparatus 11, or for any other purpose. Because the XML code in the e-mail is readable by XML parser 45, reporting and scheduling by customer relationship management system software 46 can be done automatically. It is noted that e-mail program 44 may still forward an e-mail to a customer representative, technician, or the like, particularly if an e-mail contains human-readable text.

The software on remote computer 16 is not limited to that shown in Fig. 1. For example, XML parser 45 may be replaced by a parser that is capable of parsing/reading other types of computer code, depending upon the code that is used in the received e-mail. Likewise, the parsed variables can be passed to software other than customer relationship management system software 46. For example, the variables can be stored in a database 47 for later use.

Alternative Embodiment

Referring to Fig. 6, a network 60 is shown on which an alternative embodiment of the invention is implemented. Network 60 is identical to network 10, except that e-mail program 25 in apparatus 11 is replaced by Web client 61 and e-mail program 44 in remote computer 16 is replaced by Web server 62. This alternative configuration allows embedded device 17 to transfer messages to remote computer 16 as HTTP commands rather than e-mails.

The HTTP command may be an HTTP POST command, although other HTTP commands, such as an HTTP GET command, may instead be used. An example of an HTTP POST command that uses XML code to report the status of a fictitious "widget" apparatus is as follows:

```
POST /CONTROL HTTP/1.1
Host: www.acme.com
Content-Type: text/xml
Content-length: nnn

<?xml version="1.0"?>
<root xmlns="urn:schemas-upnp-org:device-1-0">
  <specVersion>
    <major>1</major>
    <minor>0</minor>
  </specVersion>
  <device>
    <deviceType>urn:www-acme-
com:device:Widget:3</deviceType>
    <friendlyName>Widget</friendlyName>
    <manufacturer>Acme Industries</manufacturer>
    <modelName>Widget</modelName>
    <modelNumber>3</modelNumber>
    <serialNumber>53266D</serialNumber>
    <UDN>uuid:4A89EA70-73B4-11d4-80DF-0050DAB7BAC5</UDN>
```

```
    </device>
  </root>
  <parameters>
    <Airflow xsd:type="integer">378</Airflow>
    <Humidity xsd:type="double">46.7</Humidity>
    <Motor xsd:type="integer">1500</Motor>
    <Vent xsd:type="integer">4</Vent>
  </parameters>
  <alarms>
    <Temperature>
      <description>Room temperature is above
83F</description>
      <severity>300</severity>
      <status>high</status>
    </Temperature>
  </alarms>
```

XML is a self-describing computer language in the sense that fields in the XML code identify variables and their values in the XML code. For example, as shown in the above POST command, the "manufacturer" field identifies a manufacturer, e.g., "Acme Industries", and is delineated by "<manufacturer>" to indicate the start of the field and "</manufacturer>" to indicate the end of the field. XML is used in the HTTP command because it can be generated, parsed and read relatively easily by XML parser 45.

The HTTP POST command includes data identifying apparatus 11. This data includes, but is not limited to, data identifying the type of the device, a common (or "friendly") name for the device, the manufacturer of the device, the model name of the device, the model number of the device, the serial number of the device, and a

universal unique identifier (UUID) for the device. In the example post command, this data is formatted as:

```
<friendlyName>Widget</friendlyName>
<manufacturer>Acme Industries</manufacturer>
<modelName>Widget</modelName>
<modelNumber>3</modelNumber>
<serialNumber>53266D</serialNumber>
<UDN>uuid:4A89EA70-73B4-11d4-80DF-0050DAB7BAC5</UDN>
```

The HTTP POST command also provides the state of apparatus 11. The state includes operational parameters and alarm conditions for apparatus 11. In the above HTTP POST command, these are formatted as follows:

```
<parameters>
  <Airflow xsd:type="integer">378</Airflow>
  <Humidity xsd:type="double">46.7</Humidity>
  <Motor xsd:type="integer">1500</Motor>
  <Vent xsd:type="integer">4</Vent>
</parameters>
<alarms>
  <Temperature>
    <description>Room temperature is above
83F</description>
    <severity>300</severity>
    <status>high</status>
  </Temperature>
</alarms>
```

Thus, the state of the widget includes information on its airflow, humidity, motor and vent settings, temperature, severity of the temperature, and temperature status. Different information from that shown may be included in the HTTP POST command.

Referring back to Figs. 3, 4 and 5, in this embodiment the operation of processes 36, 40 and 43 is

identical to that described above, except that, in all steps, the e-mail message is replaced by an HTTP command. In apparatus 11, the HTTP command is generated by Web client 61 based on data provided by XML processor 24. This XML data is the same as that used above with e-mail program 25. Embedded device 17 sends the HTTP command to remote computer 16, where it is received by Web server 62 and then processed by XML parser 45. Thereafter, processing proceeds as above.

Architecture

Processes 36, 40 and 43 are not limited to use with the hardware/software configuration of Fig. 1; they may find applicability in any computing or processing environment. Processes 36, 40 and 43 may be implemented in hardware (e.g., an ASIC {Application-Specific Integrated Circuit} and/or an FPGA {Field Programmable Gate Array}), software, or a combination of hardware and software.

Processes 36, 40 and 43 may be implemented using one or more computer programs executing on programmable computers that each includes a processor, a storage medium readable by the processor (including volatile and non-volatile memory and/or storage elements), at least one input device, and one or more output devices.

Each such program may be implemented in a high level

procedural or object-oriented programming language to communicate with a computer system. Also, the programs can be implemented in assembly or machine language. The language may be a compiled or an interpreted language.

Each computer program may be stored on a storage medium or device (e.g., CD-ROM, hard disk, or magnetic diskette) that is readable by a general or special purpose programmable computer for configuring and operating the computer when the storage medium or device is read by the computer to perform processes 36, 40 and 43.

Processes 36, 40 and 43 may also be implemented as a computer-readable storage medium, configured with a computer program, where, upon execution, instructions in the computer program cause the computer to operate in accordance with processes 36, 40 and 43.

Other embodiments not described herein are also within the scope of the following claims. For example, e-mail or http messages sent from apparatus 11 to remote computer 16 may be queued (e.g., stored in memory 19) and then retrieved and sent out at a later time. Queuing messages reduces message loss resulting from intermittent system failures.

What is claimed is:

1. A computer-implemented method for using a device embedded in an apparatus to report the state of the apparatus to a remote computer, comprising:

detecting the state of the apparatus;

generating a message that reports the state of the apparatus using a self-describing computer language; and

sending the message to the remote computer.

2. The method of claim 1, wherein the message comprises an electronic mail message.

3. The method of claim 1, wherein the message comprises a hypertext transfer protocol command.

4. The method of claim 1, wherein the state is indicative of an error condition in the apparatus.

5. The method of claim 4, wherein the error condition comprises a variable that deviates from an acceptable value or a predetermined range of acceptable values.

6. The method of claim 1, wherein detecting the state comprises receiving the state from the apparatus.

7. The method of claim 1, wherein detecting the state comprises retrieving the state periodically from the apparatus.

8. The method of claim 1, wherein detecting the state comprises:

obtaining an identifier for the apparatus, the identifier relating to the state of the apparatus; and

reading the state from the apparatus using the identifier.

9. The method of claim 1, further comprising:

determining if the state of the apparatus has changed;

wherein the electronic mail message is generated if the state of the apparatus has changed.

10. The method of claim 9, wherein determining comprises comparing the state received from the apparatus to a previous state of the apparatus.

11. The method of claim 1, wherein the self-describing computer language comprises extensible Markup Language (XML).

12. The method of claim 1, wherein the message is generated using a predefined template, the message being generated by:

obtaining one or more variables relating to the apparatus; and

inserting the one or more variables into the template.

13. The method of claim 1, wherein the state of the apparatus is included as part of a body of the message.

14. The method of claim 1, wherein the state of the apparatus is included as part of an attachment to the message.

15. A computer-implemented method for obtaining a state of an apparatus from a device embedded in the apparatus, comprising:

receiving a message that reports the state of the apparatus using a self-describing computer language; and

extracting the state of the apparatus from the message.

16. The method of claim 15, wherein the message comprises an electronic mail message.

17. The method of claim 15, wherein the message comprises a hypertext transfer protocol command.

18. The method of claim 15, wherein the self-describing computer language comprises eXtensible Markup Language (XML).

19. The method of claim 15, wherein the state is indicative of an error condition in the apparatus.

20. The method of claim 19, wherein the error condition comprises a variable that deviates from an acceptable value or a predetermined range of acceptable values.

21. The method of claim 15, further comprising passing the state of the apparatus to a customer relationship management system.

22. A computer program stored on a computer-readable medium for reporting the state of an apparatus to a remote computer, the computer program comprising instructions that cause an embedded device in the apparatus to:

detect the state of the apparatus;

generate a message that reports the state of the apparatus using a self-describing computer language; and

send the message to the remote computer.

23. The computer program of claim 22, wherein the message comprises an electronic mail message.

24. The computer program of claim 22, wherein the message comprises a hypertext transfer protocol command.

25. The computer program of claim 22, wherein the state is indicative of an error condition in the apparatus.

26. The computer program of claim 25, wherein the error condition comprises a variable that deviates from an acceptable value or a predetermined range of acceptable values.

27. The computer program of claim 22, wherein detecting the state comprises receiving the state from the apparatus.

28. The computer program of claim 22, wherein detecting the state comprises retrieving the state periodically from the apparatus.

29. The computer program of claim 22, wherein detecting the state comprises:

obtaining an identifier for the apparatus, the identifier relating to the state of the apparatus; and

reading the state from the apparatus using the identifier.

30. The computer program of claim 22, further comprising instructions that cause the embedded device to:

determine if the state of the apparatus has changed;

wherein the message is generated if the state of the apparatus has changed.

31. The computer program of claim 30, wherein determining comprises comparing the state received from the apparatus to a previous state of the apparatus.

32. The computer program of claim 22, wherein the self-describing computer language comprises extensible Markup Language (XML).

33. The computer program of claim 22, wherein the message is generated using a predefined template, the message being generated by:

obtaining one or more variables relating to the apparatus; and

inserting the one or more variables into the template.

34. The computer program of claim 22, wherein the state of the apparatus is included as part of a body of the message.

35. The computer program of claim 22, wherein the state of the apparatus is included as part of an attachment to the message.

36. A computer program stored on a computer-readable medium for obtaining a state of an apparatus

from a device embedded in the apparatus, the computer program comprising instructions that cause a processor to:

receive a message that reports the state of the apparatus using a self-describing computer language; and

extract the state of the apparatus from the message.

37. The computer program of claim 36, wherein the message comprises an electronic mail message.

38. The computer program of claim 36, wherein the message comprises a hypertext transfer protocol command.

39. The computer program of claim 36, wherein the self-describing computer language comprises extensible Markup Language (XML).

40. The computer program of claim 36, wherein the state is indicative of an error condition in the apparatus.

41. The computer program of claim 40, wherein the error condition comprises a variable that deviates from an acceptable value or a predetermined range of acceptable values.

42. The computer program of claim 36, further comprising instructions that cause the processor to pass

the state of the apparatus to a customer relationship management system.

43. A device embedded in an apparatus for reporting the state of the apparatus to a remote computer, the embedded device comprising circuitry which:

detects the state of the apparatus;

generates a message that reports the state of the apparatus using a self-describing computer language; and

sends the message to the remote computer.

44. The device of claim 43, wherein the message comprises an electronic mail message.

45. The device of claim 43, wherein the message comprises a hypertext transfer protocol command.

46. The device of claim 43, wherein the state is indicative of an error condition in the apparatus.

47. The device of claim 46, wherein the error condition comprises a variable that deviates from an acceptable value or a predetermined range of acceptable values.

48. The device of claim 43, wherein detecting the state comprises receiving the state from the apparatus.

49. The device of claim 43, wherein detecting the state comprises retrieving the state periodically from the apparatus.

50. The device of claim 43, wherein detecting the state comprises:

obtaining an identifier for the apparatus, the identifier relating to the state of the apparatus; and

reading the state from the apparatus using the identifier.

51. The device of claim 43, wherein:

the circuitry determines if the state of the apparatus has changed; and

the message is generated if the state of the apparatus has changed.

52. The device of claim 51, wherein determining comprises comparing the state received from the apparatus to a previous state of the apparatus.

53. The device of claim 43, wherein the self-describing computer language comprises extensible Markup Language (XML).

54. The device of claim 43, wherein the message is generated using a predefined template, the message being generated by:

obtaining one or more variables relating to the apparatus; and

inserting the one or more variables into the template.

55. The device of claim 43, wherein the state of the apparatus is included as part of a body of the message.

56. The device of claim 43, wherein the state of the apparatus is included as part of an attachment to the message.

57. The device of claim 43, wherein the circuitry comprises a memory which stores executable instructions and a processor which executes the instructions.

58. The device of claim 43, wherein the circuitry comprises one or more of an application-specific integrated circuit and a programmable gate array.

59. A first apparatus for obtaining a state of a second apparatus from a device embedded in the second apparatus, the first apparatus comprising circuitry which:

receives a message that reports the state of the second apparatus using a self-describing computer language; and

extracts the state of the second apparatus from the message.

60. The first apparatus of claim 59, wherein the message comprises an electronic mail message.

61. The first apparatus of claim 59, wherein the message comprises a hypertext transfer protocol command.

62. The first apparatus of claim 59, wherein the self-describing computer language comprises extensible Markup Language (XML).

63. The first apparatus of claim 59, wherein the state is indicative of an error condition in the second apparatus.

64. The first apparatus of claim 63, wherein the error condition comprises a variable that deviates from an acceptable value or a predetermined range of acceptable values.

65. The first apparatus of claim 59, wherein the circuitry passes the state of the second apparatus to a customer relationship management system.

66. The first apparatus of claim 59, wherein the circuitry comprises a memory which stores executable instructions and a processor which executes the instructions.

67. The first apparatus of claim 59, wherein the circuitry comprises one or more of an application-specific integrated circuit and a programmable gate array.

68. A system comprising:

a first device comprising circuitry which generates a message reporting a state of an apparatus using a self-describing computer language, and

a second device, in communication with the first device, the second device comprising circuitry which receives the message from the first device.

69. The system of claim 68, wherein the message comprises an electronic mail message.

70. The system of claim 68, wherein the message comprises a hypertext transfer protocol command.

71. The system of claim 68, wherein the circuitry in the second device extracts the state of the apparatus from the electronic mail message.

72. The system of claim 68, wherein the first device is embedded in the apparatus and the second device comprises a remote computer.

73. The method of claim 1, further comprising queuing the message prior to sending the message.

74. The computer program of claim 22, further comprising instructions that cause the computer to queue the message prior to sending the message.

75. The device of claim 43, wherein the circuitry queues the message prior to sending the message.

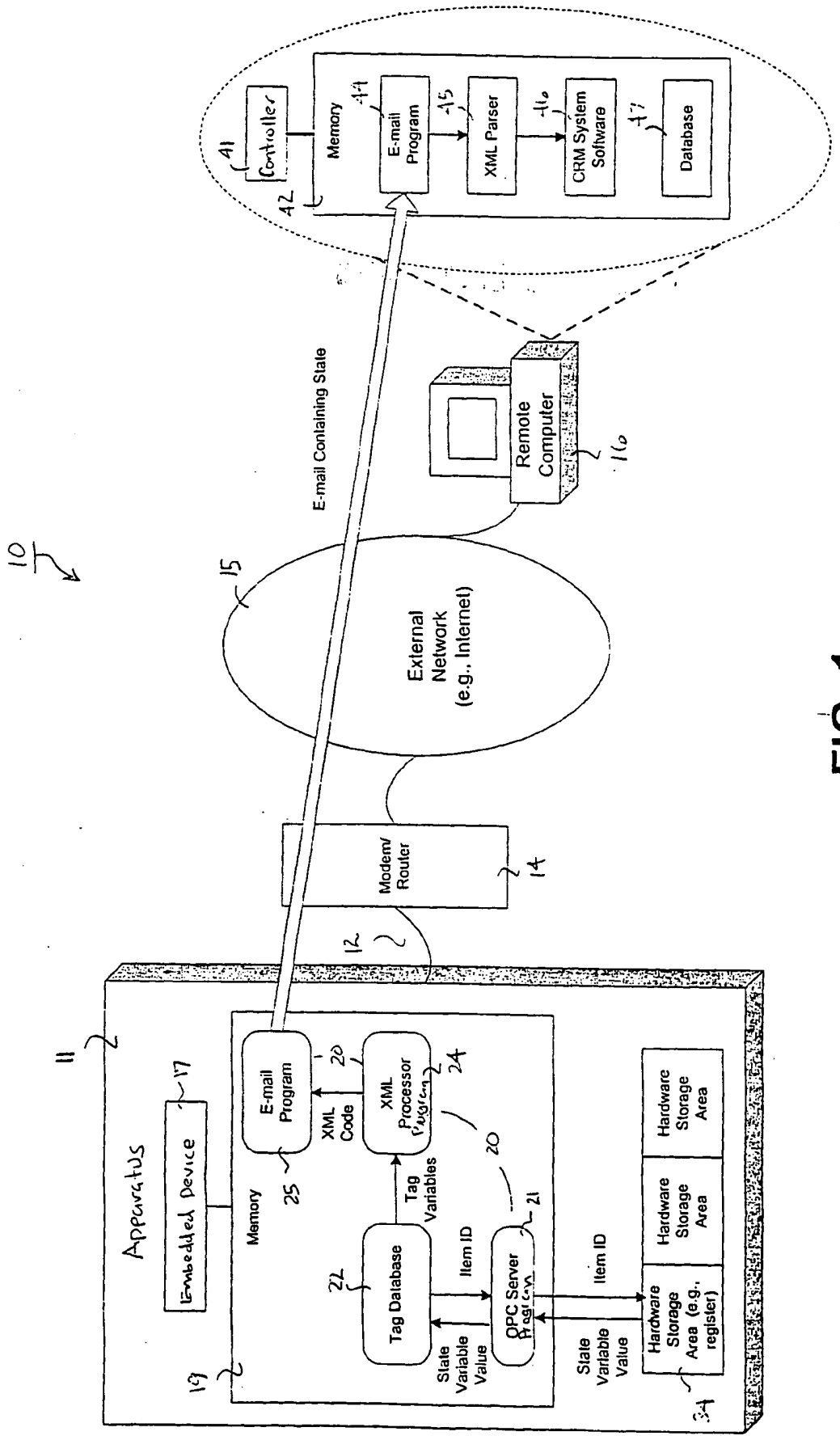
10
11
Apparatus
Embedded Device
17
19
Memory
E-mail Program
25
XML Code
20
XML Processor Program
24
Tag Variables
Tag Database
22
Item ID
OPC Server Program
21
State Variable Value
Hardware Storage Area (e.g., register)
Hardware Storage Area
Hardware Storage Area
12
Modem/ Router
14
External Network (e.g., Internet)
15
E-mail Containing State
Remote Computer
16
Controller
41
42
Memory
E-mail Program
XML Parser
CRM System Software
Database

FIG. 1

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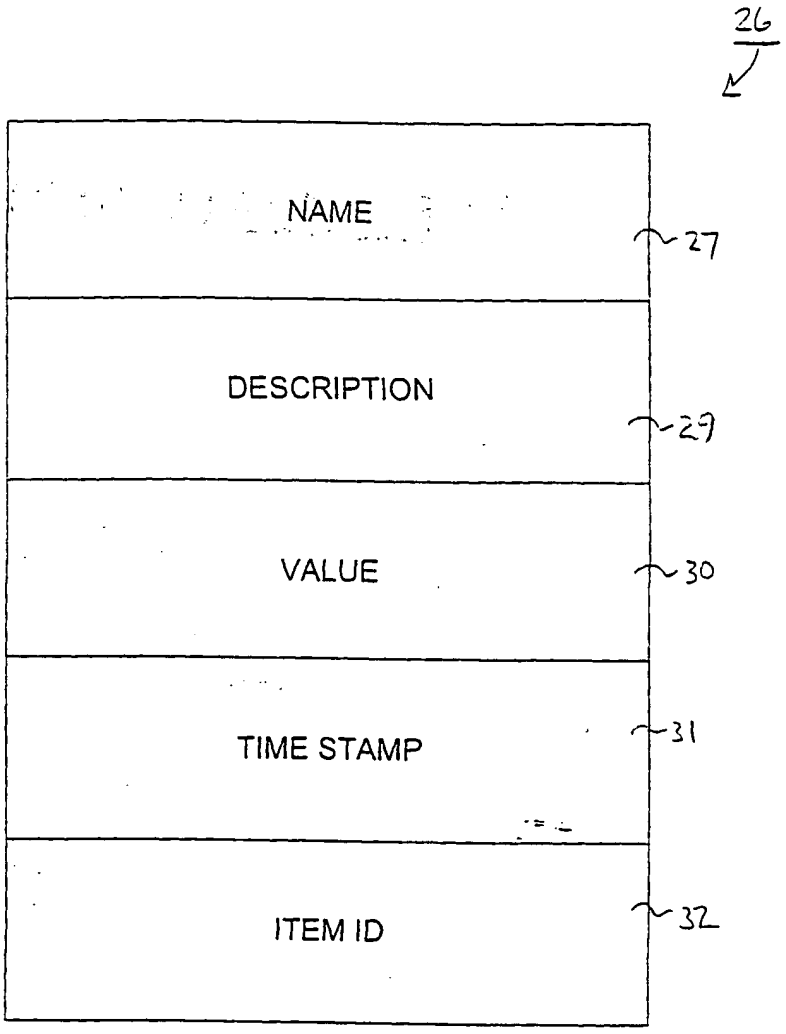

FIG. 2

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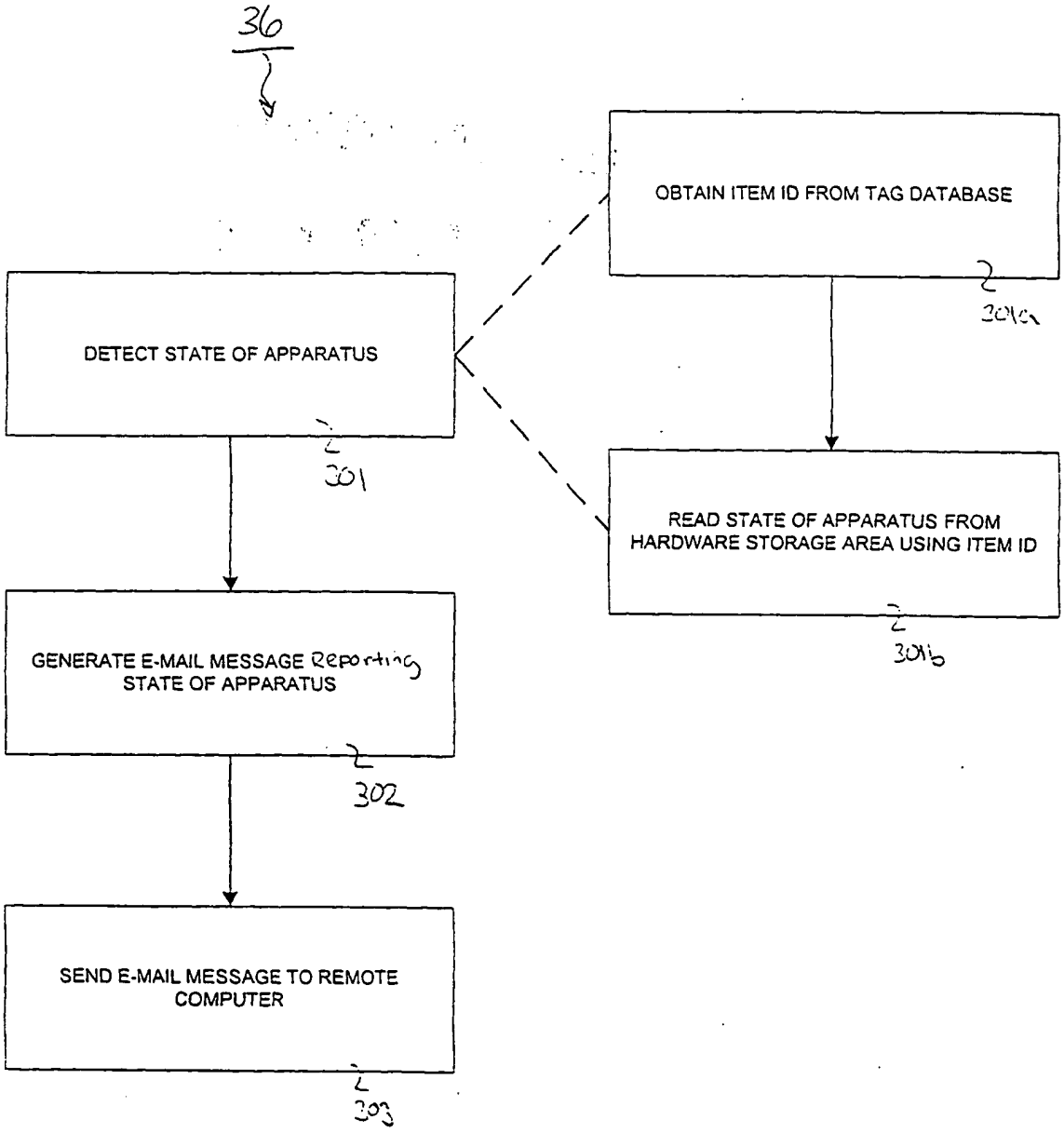
36
OBTAIN ITEM ID FROM TAG DATABASE
DETECT STATE OF APPARATUS
301
READ STATE OF APPARATUS FROM HARDWARE STORAGE AREA USING ITEM ID
GENERATE E-MAIL MESSAGE Reporting STATE OF APPARATUS
302
SEND E-MAIL MESSAGE TO REMOTE COMPUTER
303

FIG. 3

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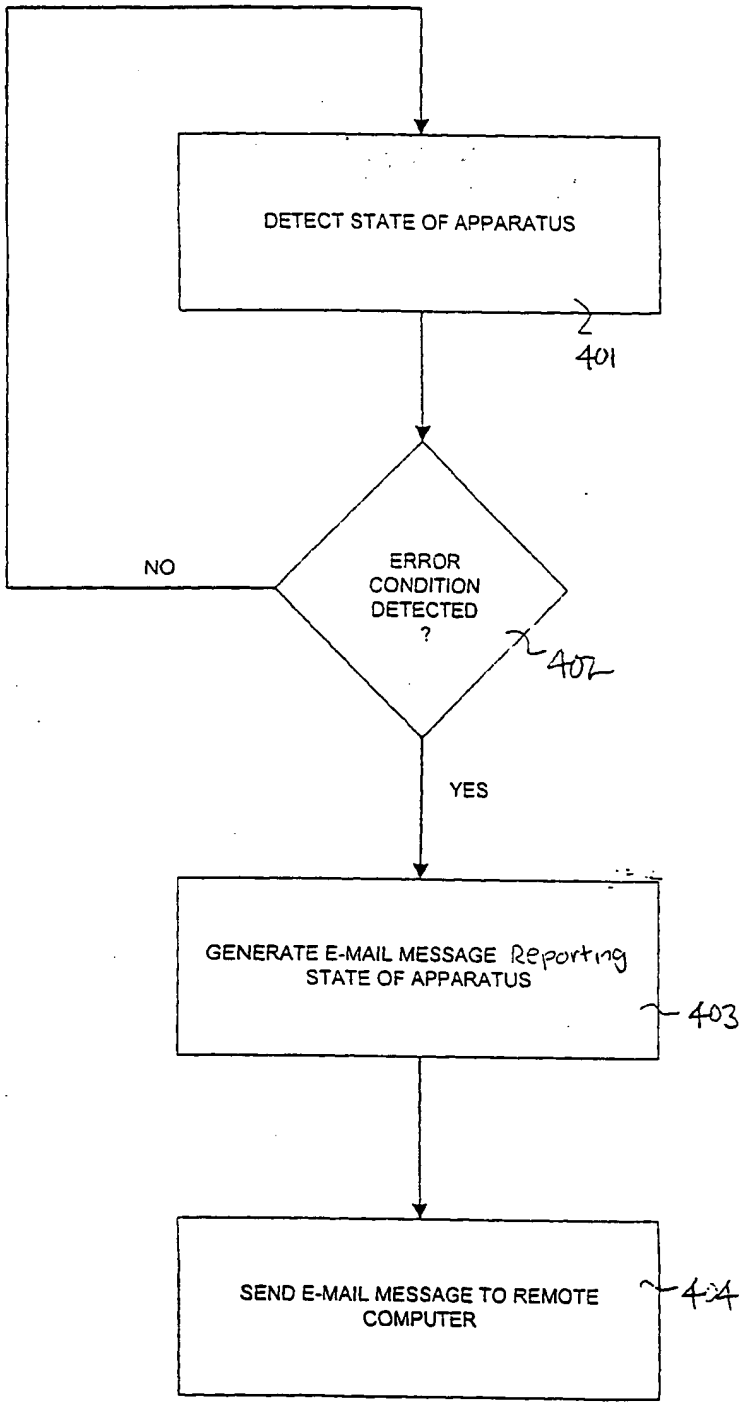
DETECT STATE OF APPARATUS
401
40
ERROR CONDITION DETECTED ?
402
NO
YES
GENERATE E-MAIL MESSAGE Reporting STATE OF APPARATUS
403
SEND E-MAIL MESSAGE TO REMOTE COMPUTER
404

FIG. 4

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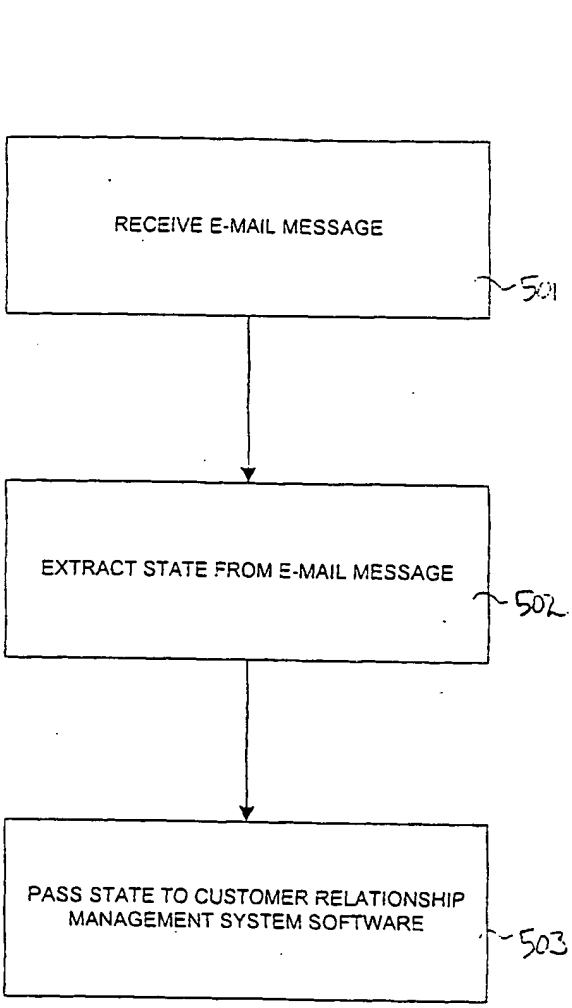
43
RECEIVE E-MAIL MESSAGE
501
EXTRACT STATE FROM E-MAIL MESSAGE
502
PASS STATE TO CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM SOFTWARE
503

FIG. 5

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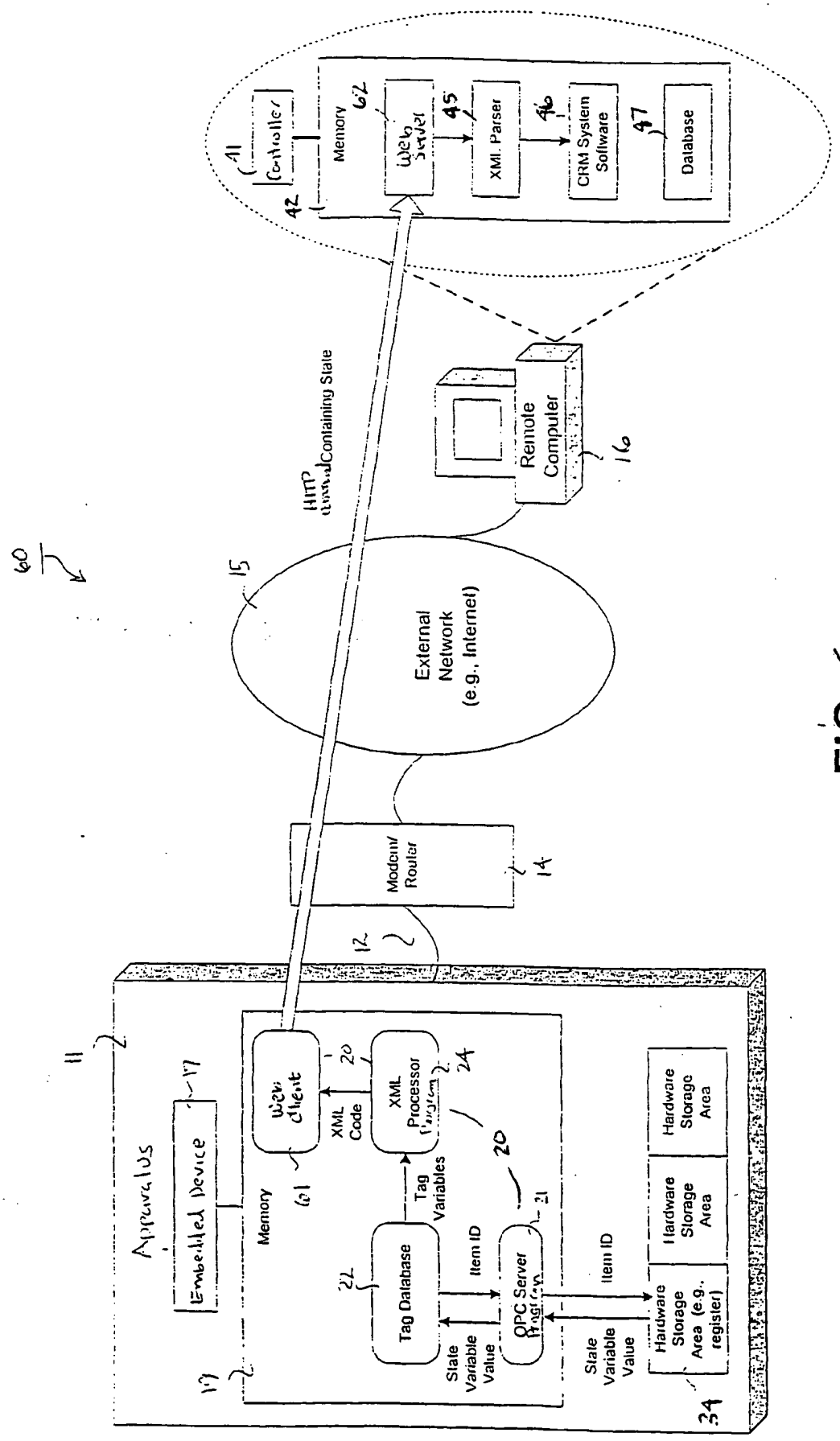
60
11
Appliance
Embedded Device
17
Memory
Web Client
61
XML Code
20
XML Processor
24
Tag Variables
20
Tag Database
22
Item ID
OPC Server
21
Item ID
State Variable Value
State Variable Value
Hardware Storage Area (e.g., register)
Hardware Storage Area
Hardware Storage Area
34
19
12
Modem/ Router
14
15
External Network (e.g., Internet)
HTTP
Containing State
Remote Computer
16
41
Controller
42
Memory
62
Web Server
45
XML Parser
46
CRM System Software
47
Database

FIG. 6

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The demand must be filed directly wi *ie competent International Preliminary Examining* *'ority or, if two or more Authorities are with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line*

IPEA/ EP

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA	Date of receipt of DEMAND

Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION

Applicant's or agent's file reference: 11333-006WO1

International application No.	International filing date *(day/month/year)*	(Earliest) Priority date *(day/month/year)*
PCT/US01/23651	27 July 2001 (27/07/01)	28 July 2000 (28/07/00)

Title of invention
REPORTING THE STATE OF AN APPARATUS TO A REMOTE COMPUTER

Box No. II APPLICANT(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

Emation , Inc.
Cabot Business Park
89 Forbes Boulevard,
Mansfield, Massachusetts 02048
United States of America

Telephone No.

Facsimile No.

Teleprinter No.

Applicant's registration No. with the Office

State *(that is, country)* of nationality:	State *(that is, country)* of residence:
US	US

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

HANSEN, James R.
66 Stoneridge Road
Franklin, Massachusetts 02038
United States of America

State *(that is, country)* of nationality:	State *(that is, country)* of residence:
US	US

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

State *(that is, country)* of nationality:	State *(that is, country)* of residence:

☐ Further applicants are indicated on a continuation sheet.

International application No.
PCT/US01/23651

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The following person is ☒ agent ☐ common representative

and ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.

☐ is hereby appointed and any earlier appointment of (an) agent(s) /common representative is hereby revoked.

☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.

Name and address: *(Family name followed by given name; for a legal entity, full official The address must include postal code and name of country.)*

PYSHER, Paul A.
Fish & Richardson P.C.
225 Franklin Street
Boston, Massachusetts 02110
United States of America

Telephone No.
617-542-5070

Facsimile No.
617-542-8906

Teleprinter No.

Agent's registration No. with the Office
40,780

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION

Statement concerning amendments:*

1. The applicant wishes the international preliminary examination **to start on the basis of:**

☒ the international application as originally filed.

the description
☐ as originally filed
☐ as amended under Article 34

the claims
☐ as originally filed
☐ as amended under Article 19 (together with any accompanying statement)
☐ as amended under Article 34

the drawings
☐ as originally filed
☐ as amended under Article 34

2. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.

3. ☐ The applicant wishes the start of the international preliminary examination **to be postponed** until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English

☒ which is the language in which the international application was filed.
☐ which is the language of a translation furnished for the purposes of international search.
☐ which is the language of publication of the international application.
☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.

Box No. V ELECTION OF STATES

The applicant hereby **elects all eligible States** *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes **not to elect:**

International application No.
PCT/US01/23651

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:			For International Preliminary Examining Authority use only: received	not received
1. translation of international application	:	sheets	☐	☐
2. amendments under Article 34	:	sheets	☐	☐
3. copy (or, where required, translation) of amendments under Article 19	:	sheets	☐	☐
4. copy (or, where required, translation) of statement under Article 19	:	sheets	☐	☐
5. letter	:	sheets	☐	☐
6. other *(specify)*	:	sheets	☐	☐

The demand is also accompanied by the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ original separate power of attorney
3. ☐ original general power of attorney
4. ☐ copy of general power of attorney; reference number, if any:
5. ☐ statement explaining lack of signature
6. ☐ sequence listing in computer readable form
7. ☒ other *(specify)*: Transmittal letter, check, postcard

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

Paul A. Pysher, Reg. No. 40,780

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:
2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):
3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply. ☐ The applicant has been informed accordingly.
4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.
5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

PCT

CHAPTER II

FEE CALCULATION SHEET

Annex to the Demand

International application No.	PCT/US01/23651
Applicant's or agent's file reference	11333-006WO1

For International Preliminary Examining Authority use only

Date stamp of the IPEA

Applicant

Emation, Inc.

CALCULATION OF PRESCRIBED FEES

1. Preliminary examination fee	1,533.00	P
2. Handling fee *(Applicants from certain States are entitled to a reduction of 75% of the handling fee. Where the applicant is (or all applicants are) so entitled, the amount to be entered at H is 25% of the handling fee.)*	159.00	H
3. Total of prescribed fees Add the amounts entered at P and H and enter total in the TOTAL box	1,692.00	TOTAL

MODE OF PAYMENT

- [X] authorization to charge deposit account with the IPEA (see below)
- [ ] cheque
- [ ] postal money order
- [ ] bank draft
- [ ] cash
- [ ] revenue stamps
- [ ] coupons
- [ ] other *(specify)*:

AUTHORIZATION TO CHARGE (OR CREDIT) DEPOSIT ACCOUNT

(This mode of payment may not be available at all IPEAs)

- [X] Authorization to charge the total fees indicated above.
- [ ] *(This check-box may be marked only if the conditions for deposit accounts of the IPEA so permit)* Authorization to charge any deficiency or credit any overpayment in the total fees indicated above.

IPEA/ EP

Deposit Account No.: 28300223

Date: February 26, 2002

Name: Paul A. Pysher

Signature:

See Notes to the fee calculation sheet

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference *(if desired) (12 characters maximum)* 11333-006WO1

Box No. I TITLE OF INVENTION

REPORTING THE STATE OF AN APPARATUS TO A REMOTE COMPUTER

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

eMation, Inc.
Cabot Business Park
89 Forbes Boulevard
Mansfield, Massachusetts 02048
United States of America

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State *(that is, country)* of nationality: US

State *(that is, country)* of residence: US

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

HANSEN, James R.
66 Stoneridge Road
Franklin, Massachusetts 02038
United States of America

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: US

State *(that is, country)* of residence: US

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

PYSHER, Paul A.
FISH & RICHARDSON P.C.
225 Fr anklin Street
Boston, Massachusetts 02110
United States of America

Telephone No.
(617) 542- 5070

Facsimile No.
(617) 542-8906

Teleprinter No.

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes: at least one must be marked)*:

Regional Patent

☒ **AP ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, MZ Mozambique, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT

☒ **EA Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT

☒ **EP European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT

☒ **OA OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* .....

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

☒ AE United Arab Emirates
☒ AG Antigua and Barbuda
☒ AL Albania
☒ AM Armenia
☒ AT Austria
☒ AU Australia
☒ AZ Azerbaijan
☒ BA Bosnia and Herzegovina
☒ BB Barbados
☒ BG Bulgaria
☒ BR Brazil
☒ BY Belarus
☒ BZ Belize
☒ CA Canada
☒ CH and LI Switzerland and Liechtenstein
☒ CN China
☒ CR Costa Rica
☒ CU Cuba
☒ CZ Czech Republic
☒ DE Germany
☒ DK Denmark
☒ DM Dominica
☒ DZ Algeria
☒ EE Estonia
☒ ES Spain
☒ FI Finland
☒ GB United Kingdom
☒ GD Grenada
☒ GE Georgia
☒ GH Ghana
☒ GM Gambia
☒ HR Croatia
☒ HU Hungary
☒ ID Indonesia
☒ IL Israel
☒ IN India
☒ IS Iceland
☒ JP Japan
☒ KE Kenya
☒ KG Kyrgyzstan
☒ KP Democratic People's Republic of Korea
☒ KR Republic of Korea
☒ KZ Kazakhstan
☒ LC Saint Lucia
☒ LK Sri Lanka
☒ LR Liberia
☒ LS Lesotho
☒ LT Lithuania
☒ LU Luxembourg
☒ LV Latvia
☒ MA Morocco
☒ MD Republic of Moldova
☒ MG Madagascar
☒ MK The former Yugoslav Republic of Macedonia
☒ MN Mongolia
☒ MW Malawi
☒ MX Mexico
☒ MZ Mozambique
☒ NO Norway
☒ NZ New Zealand
☒ PL Poland
☒ PT Portugal
☒ RO Romania
☒ RU Russian Federation
☒ SD Sudan
☒ SE Sweden
☒ SG Singapore
☒ SI Slovenia
☒ SK Slovakia
☒ SL Sierra Leone
☒ TJ Tajikistan
☒ TM Turkmenistan
☒ TR Turkey
☒ TT Trinidad and Tobago
☒ TZ United Republic of Tanzania
☒ UA Ukraine
☒ UG Uganda
☒ US United States of America Continuation
☒ UZ Uzbekistan
☒ VN Viet Nam
☒ YU Yugoslavia
☒ ZA South Africa
☒ ZW Zimbabwe

Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet:

☒ .....

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)*

Supplemental Box *If the Supplemental Box is not used, this sheet need not be included in the request.*

*1. If, in any of the Boxes, **the space is insufficient** to furnish all the information: in such case, write "Continuation of Box No. ..." [indicate the number of the Box] and furnish the information in the same manner as required according to the captions of the Box in which the space was insufficient, in particular:*

*(i) **if more than two persons are involved as applicants and/or inventors** and no "continuation sheet" is available: in such case, write "Continuation of Box No. III" and indicate for each additional person the same type of information as required in Box No. III. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below;*

*(ii) if, in Box No. II or in any of the sub-boxes of Box No. III, the indication **"the States indicated in the Supplemental Box"** is checked: in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the applicant(s) involved and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is applicant;*

*(iii) if, in Box No. II or in any of the sub-boxes of Box No. III, **the inventor or the inventor/applicant is not inventor for the purposes of all designated States or for the purposes of the United States of America:** in such case, write "Continuation of Box No. II" or "Continuation of Box No. III" or "Continuation of Boxes No. II and No. III" (as the case may be), indicate the name of the inventor(s) and, next to (each) such name, the State(s) (and/or, where applicable, ARIPO, Eurasian, European or OAPI patent) for the purposes of which the named person is inventor;*

*(iv) if, in addition to the agent(s) indicated in Box IV, there are **further agents**: in such case, write "Continuation of Box No. IV" and indicate for each further agent the same type of information as required in Box No. IV;*

*(v) if, in Box No. V, the name of any State (or OAPI) is accompanied by the indication **"patent of addition,"** or **"certificate of addition,"** or if, in Box No. V, the name of the United States of America is accompanied by an indication **"continuation"** or **"continuation-in-part"**: in such case, write "Continuation of Box No. V" and the name of each State involved (or OAPI), and after the name of each such State (or OAPI) , the number of the parent title or parent application and the date of grant of the parent title or filing of the parent application;*

*(vi) if, in Box No. VI, there are **more than three earlier applications whose priority is claimed**: in such case, write "Continuation of Box No. VI" and indicate for each additional earlier application the same type of information as required in Box No. VI;*

*(vii) if, in Box No. VI, **the earlier application is an ARIPO application**: in such case, write "Continuation of Box No. VI", specify the number of the item corresponding to that earlier application and indicate at least one country party to the Paris Convention for the Protection of Industrial Property or one Member of the World Trade Organization for which that earlier application was filed.*

*2. If, with regard to the **precautionary designation statement** contained in Box No. V, the applicant wishes to exclude any State(s) from the scope of that statement: in such case, write "Designation(s) excluded from precautionary designation statement" and indicate the name or two-letter code of each State so excluded.*

*3. If the applicant claims, in respect of any designated Office, the benefits of provisions of the national law concerning **non-prejudicial disclosures or exceptions to lack of novelty**: in such case, write "Statement concerning non-prejudical disclosures or exceptions to lack of novelty" and furnish that statement below.*

Continuation of Box V

Continuation of USSN: 09/627,201
Filed: 28 July 2000

Continuation of USSN: 09/708,384
Filed: 8 November 2000

Box No. VI PRIORITY CLAIM ☐ Further priority claims are indicated in the Supplemental Box.

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is: national application: country	regional application:* regional Office	international application: receiving Office
item (1) 28 July 2000 (28.07.00)	09/627,201	US		
item (2) 8 November 2000 (08.11.00)	09/708,384	US		
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): 1&2

* *Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):*

ISA/ EP

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority):*

Date *(day/month/year)* Number Country *(or regional Office)*

Box No. VIII CHECK LIST: LANGUAGE OF FILING

This international application contains the following **number of sheets:**

request	:	4
description (excluding sequence listing part)	:	23
claims	:	13
abstract	:	1
drawings	:	6
sequence listing part of description	:	0
Total number of sheets	:	47

This international application is **accompanied** by the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☒ other *(specify)*: postcard and check

Figure of the drawings which should accompany the abstract:

Language of filing of the international application: English

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Paul A. Pysher Reg# 40,780

For receiving Office use only

1. Date of actual receipt of the purported international application:
2. Drawings: ☐ received: ☐ not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:
4. Date of timely receipt of the required corrections under PCT Article 11(2):
5. International Searching Authority (if two or more are competent): ISA/
6. ☐ Transmittal of search copy delayed until search fee is paid.

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

This sheet is not part of and does not count as a sheet of the international application.

PCT

FEE CALCULATION SHEET

Annex to the Request

For receiving Office use only

International application No.

Date stamp of the receiving Office

Applicant's or agent's file reference: **11333-006WO1**

Applicant: **eMation, Inc.**

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE . . . . . **240.00** T

2. SEARCH FEE . . . . . **846.00** S

International search to be carried out by **EP**

(If two or more International Searching Authorities are competent in relation to the international application, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

Basic Fee

The international application contains **41** sheets.

first 30 sheets **382.00** b1

11 remaining sheets x **$9.00** additional amount = **99.00** b2

Add amounts entered at b1 and b2 and enter total at B . . **481.00** B

Designation Fees

The international application contains **6** designations.

6 number of designation fees payable *(maximum 6)* x **82.00** amount of designation fee = **492.00** D

Add amounts entered at B and D and enter total at I . . . . . **973.00** I

(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled, the

4. FEE FOR PRIORITY DOCUMENT *(if applicable)* . . . . . **30.00** P

5. TOTAL FEES PAYABLE . . . . . **2,089.00** TOTAL

Add amounts entered at T, S, I and P, and enter total in the TOTAL box

☐ The designation fees are not paid at this time.

MODE OF PAYMENT

- ☒ authorization to charge deposit account (see below)
- ☐ bank draft
- ☐ coupons
- ☒ cheque
- ☐ cash
- ☐ other *(specify)*:
- ☐ postal money order
- ☐ revenue stamps

DEPOSIT ACCOUNT AUTHORIZATION *(this mode of payment may not be available at all receiving Offices)*

The RO/ **US**

☐ is hereby authorized to charge the total fees indicated above to my deposit account.

☒ *(this check-box may be marked only if the conditions for deposit accounts of the receiving Office so permit)* i hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to m deposit account.

☐ is hereby authorized to charge the fee for preparation and transmittal of the priority document to the International Bureau of WIPO to my deposit account.

06-1050 Deposit Account No.

July 27,2001 Date *(day/month/year)*

Signature

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PATENT COOPERATION TREAT

NLB PAP

RECEIVED OCT 21 2002 FISH & RICHARDSON, P.C. BOSTON OFFICE

PCT

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
PYSHER, Paul A.
FISH & RICHARDSON P.C.
225 Franklin Street
Boston, MA 02110
ETATS-UNIS D'AMERIQUE

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing *(day/month/year)*	15/10/2002
Applicant's or agent's file reference: 11333-006WO1	IMPORTANT NOTIFICATION

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 01/23651	27/07/2001	28/07/2000

Applicant

EMATION, INC. et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

* No Docketing Required *
Reviewed By Practice Systems
Initials: JMG
Reviewed By Billing Secretary
Initials:

Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. (+49-89) 2399-0, Tx: 523656 epmu d Fax: (+49-89) 2399-4465	CHAVONAND F H Tel. (+49-89) 2399 2828

Form PCT/IPEA/416 (August 2002) P20473

PATENT COOPERATION TREAT

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
11333-006W01		
International application No.	International filing date (day/month/year)	Priority date (day/month/year)
PCT/US 01/23651	27/07/2001	28/07/2000
International Patent Classification (IPC) or national classification and IPC		
G06F11/00		
Applicant		
EMATION, INC. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 2 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consists of a total of _____ sheets.

3. This report contains indications relating to the following items:

   I ☒ Basis of the report

   II ☐ Priority

   III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

   IV ☐ Lack of unity of invention

   V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

   VI ☐ Certain documents cited

   VII ☐ Certain defects in the international application

   VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
26/02/2002	10/10/2002
Name and mailing address of the IPEA/	Authorized officer
European Patent Office D-80298 Munich Tel. (+49-89) 2399-0, Tx: 523656 epmu d Fax: (+49-89) 2399-4465	SKULIKARIS I Tel. (+49-89) 2399 2828

I. Basis of the report

The basis of this international preliminary examination is the application as originally filed.

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability

In light of the documents cited in the international search report, it is considered that the invention as defined in at least some of the claims does not appear to meet the criteria mentioned in Article 33(1) PCT, i.e. does not appear to be novel and/or to involve an inventive step (see international search report, in particular the documents cited X and/or Y and corresponding claim references).

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PAP

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

PCT

To:
PYSHER, Paul A.
FISH & RICHARDSON P.C.
225 Franklin Street
Boston, MA 02110
ETATS-UNIS D'AMERIQUE

RECEIVED
AUG 19 2002
FISH & RICHARDSON, P.C.
BOSTON OFFICE

WRITTEN OPINION

(PCT Rule 66)

Date of mailing *(day/month/year)*	13/08/2002
Applicant's or agent's file reference: 11333-006WO1	**REPLY DUE** within 1 / 00 months/days from the above date of mailing

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US 01/23651	27/07/2001	28/07/2000

International Patent Classification (IPC) or both national classification and IPC
G06F11/00

Applicant
EMATION, INC. et al.

1. This written opinion is the first drawn up by this International Preliminary Examining Authority.
2. This opinion contains indications relating to the following items:
   - I [X] Basis of the opinion
   - II [ ] Priority
   - III [ ] Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV [ ] Lack of unity of invention
   - V [X] Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI [ ] Certain documents cited
   - VII [ ] Certain defects in the international application
   - VIII [ ] Certain observations on the international application

Docketed by [illegible] Secretary
Due Date:
Deadline:
Initials:

Rsp to Opinion 9/18/02
CAS

3. The applicant is hereby **invited to reply** to this opinion.
   When? See the time limit indicated above. The applicant may, before the expiration of that time limit, request this Authority to grant an extension, see Rule 66.2(d).
   How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3. For the form and the language of the amendments, see Rules 66.8 and 66.9.
   Also For an additional opportunity to submit amendments, see Rule 66.4. For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4*bis*. For an informal communication with the examiner, see Rule 66.6.

   If no reply is filed, the international preliminary examination report will be established on the basis of this opinion.
4. The final date by which the international preliminary examination report must be established according to Rule 69.2 is: 28/11/2002

Name and mailing address of the IPEA/
European Patent Office
D-80298 Munich
Tel. (+49-89) 2399-0, Tx: 523656 epmu d
Fax: (+49-89) 2399-4465

Authorized officer
Examiner
Formalities officer
(incl. extension of time limits)
Tel. (+49-89) 2399 2828

EUROPÄISCHES PATENTAMT · EUROPEAN PATENT OFFICE · OFFICE EUROPÉEN DES BREVETS

I. Basis of the opinion

1. The basis of this written opinion is the application as originally filed.

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability

1. In light of the documents cited in the international search report, it is considered that the invention as defined in at least some of the claims does not appear to meet the criteria mentioned in Article 33(1) PCT, i.e. does not appear to be novel and/or to involve an inventive step (see international search report, in particular the documents cited X and/or Y and corresponding claims references).

2. If amendments are filed, the applicant should comply with the requirements of Rule 66.8 PCT and indicate the basis of the amendments in the documents of the application as originally filed (Article 34 (2) (b) PCT) otherwise these amendments may not be taken into consideration for the establishment of the international preliminary examination report. The attention of the applicant is drawn to the fact that if the application contains an unnecessary plurality of independent claims, no examination of any of the claims will be carried out.

NB: Should the applicant decide to request detailed substantive examination, then an international preliminary examination report will normally be established directly. Exceptionally the examiner may draw up a second written opinion, should this be explicitly requested.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
7 February 2002 (07.02.2002)

PCT

(10) International Publication Number
WO 02/010919 A3

(51) International Patent Classification[7]: G06F 11/30

(21) International Application Number: PCT/US01/23651

(22) International Filing Date: 27 July 2001 (27.07.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

09/627,201	28 July 2000 (28.07.2000)	US
09/708,384	8 November 2000 (08.11.2000)	US

(63) Related by continuation (CON) or continuation-in-part (CIP) to earlier applications:

US	09/708,384 (CON)
Filed on	8 November 2000 (08.11.2000)
US	09/627,201 (CON)
Filed on	28 July 2000 (28.07.2000)

(71) Applicant *(for all designated States except US)*: **EMATION, INC.** [US/US]; Cabot Business Park, 89 Forbes Boulevard, Mansfield, MA 02048 (US).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **HANSEN, James, R.** [US/US]; 66 Stoneridge Road, Franklin, MA 02038 (US).

(74) Agent: **PYSHER, Paul, A.**; Fish & Richardson P.C., 225 Franklin Street, Boston, MA 02110 (US).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

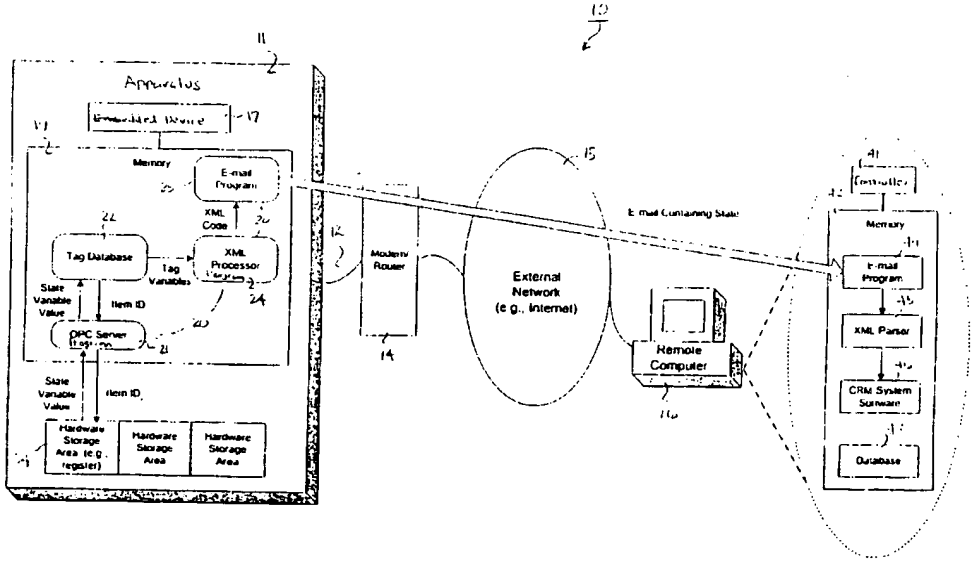
— *with international search report*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(88) Date of publication of the international search report:
1 August 2002

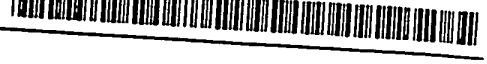
[Continued on next page]

(54) Title: REPORTING THE STATE OF AN APPARATUS TO A REMOTE COMPUTER



(57) Abstract: The state of an apparatus is reported to a remote computer using an embedded device in the apparatus. The embedded device detects the state, generates a message that reports the state using a self-describing computer language, and sends the message to the remote computer. The remote computer receives the message and extracts the state of the embedded device from the message.

WO 02/010919 A3



For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 01/23651

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06F11/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06F H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
WPI Data, PAJ, EPO-Internal, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category.°	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 07, 29 September 2000 (2000-09-29) -& JP 2000 122952 A (FUJI XEROX CO LTD), 28 April 2000 (2000-04-28) abstract paragraph '0017! ---	1-75
X	WO 99 57838 A (SAMSUNG ELECTRONICS CO LTD) 11 November 1999 (1999-11-11) page 3, line 5 - line 26 page 9, line 26 -page 10, line 32 page 18, line 20 -page 23, line 23 page 43, line 45 -page 44, line 4 --- -/--	1-75

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
23 May 2002	03/06/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Herreman, G

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 01/23651

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 99 57649 A (RAMBERG JON R ;HUNT JEFFREY M (US); SHOEMAN PAUL D (US); INTERMEC) 11 November 1999 (1999-11-11) claims 1-13,45-48	1-75
A	WO 00 23894 A (PLAUM REINER ;SIEMENS AG (DE); TALANIS THOMAS (DE); BLUMENSTOCK WE) 27 April 2000 (2000-04-27) page 1, line 1 -page 3, line 22	1-75

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

nformation on patent family members

In tional Application No
PCT/US 01/23651

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2000122952 A	28-04-2000	NONE	
WO 9957838 A	11-11-1999	AU 3734199 A	23-11-1999
		AU 3734299 A	23-11-1999
		AU 3734399 A	23-11-1999
		CN 1316160 T	03-10-2001
		CN 1311935 T	05-09-2001
		CN 1311936 T	05-09-2001
		EP 1084576 A2	21-03-2001
		EP 1076960 A2	21-02-2001
		EP 1082838 A2	14-03-2001
		WO 9957837 A2	11-11-1999
		WO 9957838 A2	11-11-1999
		WO 9957839 A2	11-11-1999
WO 9957649 A	11-11-1999	AU 3878699 A	23-11-1999
		WO 9957649 A2	11-11-1999
WO 0023894 A	27-04-2000	DE 19848618 A1	29-06-2000
		WO 0023894 A1	27-04-2000
		EP 1131717 A1	12-09-2001
		US 2002006790 A1	17-01-2002

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